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A CONTRIBUTION TO THE TECHNIQUE FOR PROPAGATION OF *CHELONUS ANNULIPES* WESM.; AN IMPORTED PARASITE OF THE EUROPEAN CORN BORER.

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The matter offered for consideration in this paper deals entirely with one phase of the rearing of *Chelonus annulipes* Wesm., a larval parasite ovipositing in the egg of the European Corn Borer, *Pyrausta nubilalis* Hubn. This phase, the effect on the percentage of successful parasitism, of the age of the host eggs at the time of attack, is one of the more important factors determining the success or failure of laboratory rearing and distribution of this species. The data from the breeding work are substantiated by histological findings and present what is believed to be some new information on the early development of this entomophagous insect. The paper also demonstrates the value of an early attack on problems of this sort from the histological point of view. In the present case the conclusions as to the most desirable time at which to present the eggs for parasitism had already been arrived at before the histological work was started. The histological studies, however, confirm and clarify these conclusions and indicate how much more quickly and accurately problems of this nature may be solved by the combination of breeding and histological studies than by breeding work alone.

The problem in hand was that of rearing *Chelonus annulipes* for liberation. This species is an important parasite of the corn borer in Europe but occurs only in certain localized areas, particularly in Northern Italy, and it has not been possible to secure it in large numbers for liberation in America. The results secured from small liberations indicated that it might be well adapted to Canadian conditions, and laboratory propagation to facilitate its rapid distribution was considered advisable. We take this opportunity to acknowledge our indebtedness to Messrs. D. J. Caffrey and D. W. Jones, of the United States Bureau of Entomology, through whose offices we were supplied with breeding stock and details of the technique developed at the Arlington Corn Borer Laboratory, which made our work with this parasite possible.

The life-history of *Chelonus* is very different from that of any other corn borer parasite yet recorded and is given briefly here in order that the remainder of the paper may be intelligible. The egg is deposited in the egg of the host, which, however, does not prevent its normal hatching with the parasite inside. Both parasitized and unparasitized larvae develop at about the same rate until the fourth instar, when parasitized larvae cease growing and assume a characteristic

* The data on the biology and rearing of *Chelonus annulipes* Wesm. used in this paper were secured in four seasons (1930-33) breeding of the species under the direction of Mr. Wishart. The histological sections were made by Dr. van Steenburgh in the autumn of 1933.

creamy white appearance. Within the host in this condition, the parasite hibernates as a first stage larva. In the spring the parasite continues its development, finally leaving the host and spinning a cocoon. Emergence of adults occurs at about the same time as the corn borer eggs are being laid, thus synchronizing almost perfectly with the normal life cycle of the host. Under laboratory conditions, with constant temperature of 82°F., development of the parasite within the host is continuous and parasite cocoons are formed an average of approximately 22 days after oviposition takes place. Emergence occurs in 6 days and females are ready to mate and oviposit immediately. Several generations may thus be completed in one season in the laboratory, greatly facilitating laboratory propagation for liberation. In the main the problem resolves itself into getting the host eggs successfully parasitized and in rearing the host larvae hatching from these until the parasite larvae leave them and form cocoons. The latter part of this work has been described before (1), and the procedure throughout the season is uniform but, due to variations in the food supply for host rearing and other factors reliable data on percentage of parasitism cannot be secured except by experiments over a comparatively long period. This explains why conclusive figures were not secured earlier in the work.

Getting a high percentage of the host eggs parasitized was thought to be related to the following factors: temperature, humidity, light intensity, age of parasites, and manner of presentation of the host eggs to the parasites. Using freshly deposited host eggs, many combinations of these factors were tried out over varying periods. It did not appear that any of them was critical, but all gave uniformly low percentages of parasitism. Dissection, however, showed that eggs were actually being laid in a large percentage of the host eggs exposed for parasitism, and we were forced to the conclusion that there was some condition within the host egg itself which was inimical to the proper development or establishment of the parasite.

The matter of the age of the host eggs at the time of exposure to parasitism was not attacked earlier in the work because the studies at Arlington seemed to show that this was not important. Vance, (2) in his bulletin on the biology and morphology of this species, states. "Apparently the age of the host eggs does not influence the choice of the female or the development of the parasite." Some of our own early work also showed that very fresh eggs allowed of the development of the parasite. Cox, (3) in referring to *Ascogaster carpocapsae* Viereck, a species of similar biology, states in part, "Although apparently the parasite egg may be deposited anywhere within the cytoplasm of the host egg, it has never been found deposited in such a position that it would be inside the host embryo when the latter developed,—. Nor has it ever been found deposited within the developing embryo." In the light of these opinions, we continued until the end of the

(1) Briand, L. J.—Laboratory Breeding of the European Corn Borer with Special Reference to Equipment and Cages. Can. Ent. Vol. LXI, No. 3, Mar. 1929.

(2) The Biology and Morphology of the Braconid *Chelonus annulipes* Wesm., A Parasite of the European Corn Borer, by Arlo M. Vance, U.S.D.A. Tech. Bul. No. 294, May, 1932.

(3) *Ascogaster carpocapsae* Viereck, An Important Larval Parasite of the Codling Moth and the Oriental Fruit Moth, by Jas. A. Cox, N. Y. State Agr. Exp. Sta. Tech. Bul. No. 188, Jan., 1932.

1932 liberation season to expose for parasitism corn borer eggs which were less than 24 hours old.

At that time it was decided to run some small lots wherein the host eggs were of varying ages. Eggs of less than 24 hours incubation were compared with those 60 hours old and those just ready to hatch, with the following results:

Age of Host Eggs	% Cocoons From Larvae Isolated
Less than 24 hours	26.6
Approximately 60 hours	36.0
Ready to hatch, 84 to 90 hours.	11.4

It may be stated here that corn borer eggs are removed from the oviposition cages each morning. The eggs referred to as 24 hour eggs may thus be of any age under 24 hours. Most of these eggs would be laid the previous evening, making them about 12 to 15 hours old when presented for parasitism. Those described as 60 hour eggs were kept 48 hours after removal from the oviposition cages and before parasitism. Those in the third lot were kept 72 hours before parasitism. The number of eggs used was not large enough to adequately cover the effect of variations but these experiments showed a decided difference in effective parasitism at the three periods in development.

In May, 1933, for a period of 8 days, only eggs of approximately 80 hours incubation were presented for parasitism, and for another 8 day period only those of 60 hours incubation. The percentage of the surviving larvae, which yielded parasites for the 80 hour eggs was 29.9, and for the 60 hour eggs 47.5. During the remainder of the season only eggs of approximately 60 hours incubation were exposed for parasitism and with consistently good results. A comparison of the figures for the 1932 rearing work, when eggs less than 24 hours old were used, with those of 1933 when 60 hour eggs were used, follows:

	No. Host Larvae Reared Through		No. Parasite Cocoons Secured		% Cocoons of Host Reared	
	1932	1933	1932	1933	1932	1933
May	5814	2293	1389	1030	23.9	44.9
June	3440	2751	1060	1458	30.8	52.9
July	122	3493	20	2052	16.4	58.7
Aug.		729		466		63.9
	9376	9266	2469	5006	26.4	54.0

Conditions in the laboratory were very similar throughout the two seasons compared; the same workers performed the routine work and the general technique was almost identical. If it were possible to secure a high percentage of the 24 hour eggs to yield parasites, it would probably have occurred at some time during the season. The highest percentage secured was, however, 44.4 and the average for the 10 best lots, 41.9 per cent, while for 60 hour eggs the highest parasitism secured was 95.9 per cent and the average for the 10 best lots 83.0 per cent.

The importance of this from the standpoint of large scale rearing can readily be appreciated and, with a view to determining the reason for the differ-

ence, serial sections were made of corn borer eggs parasitized by *Chelonus* at various stages in embryonic development. The eggs used were of known ages and several lots were allowed to develop for a time after parasitism, in order that the fate of the parasite might be observed. The eggs were killed and fixed in warm Bouins Fixing Fluid, sectioned by the paraffin method and stained with Delafields haematoxylin and eosin.

At a constant temperature of 80°-82°F. the corn borer eggs develop from oviposition to hatching in 87 to 90 hours. The blastoderm is formed in 5 to 6 hours and the germ band is distinct at 9 to 10 hours. By 16 to 18 hours the germ band is complete and is immersed in the yolk. At 27 hours the head lobes are well developed and segmentation is distinct. By 52 hours the leg segments are prominent and between this age and 60 hours the dorsal line is closed and the embryo rotates to assume its final orientation. Development within the *Chelonus* egg is comparatively rapid and by 24 to 26 hours at 80°F. the larva is ready for eclosion.

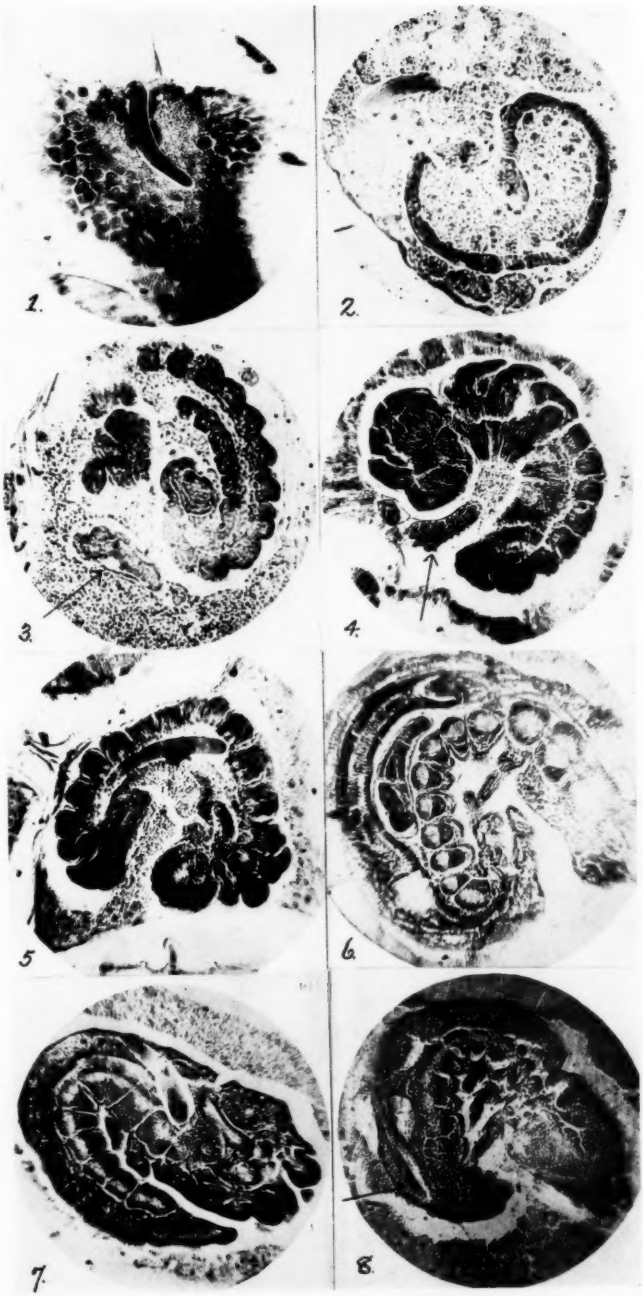
If the parasite eggs are deposited in the yolk of the host eggs before or during the early development of the germ band, the parasite larvae hatching from these eggs may pass between the lateral folds of the developing host before the completion of the dorsal closure and become successfully established. Eggs deposited in the yolk after the dorsal closure appear to represent a total mortality and the ratio of parasite establishment from eggs oviposited in the yolk appears to diminish as the period of time between parasite hatching and the dorsal closure becomes shorter. After the appearance of distinct segmentation (25-35 hours) of the developing host, it seems probable that survival and establishment of the parasite is dependent upon the eggs being placed in a suitable position in the embryo. The ratio of establishment then increases as the embryo increases in size at the time of parasitization, and after the rotation to its final orientation, practically all of the parasite eggs are placed within the embryo and undergo normal development.

The sections showed parasite eggs in all parts of the embryo but in dissection of host larvae after hatching the young parasite larvae are always found in the region of the malpighian tubes. As observed by Cox in his studies on *Ascogaster* our sections showed that *Chelonus* eggs deposited in infertile host eggs failed to develop.

It is realized that these studies are very incomplete and more detailed experiments will be carried out as time and material permits. The facts presented are, however, of great importance in connection with the economical production and distribution of this parasite, and also as indicating a valuable line of attack on other problems of a similar nature in biological control work. The photographs presented herewith illustrate a few of the more important points brought out in the histological studies.

EXPLANATION OF PLATE

1. *Chelonus* egg deposited in a freshly deposited European Corn Borer egg. The parasite hatching from this egg has a high probability of establishment.
2. Section of egg showing young germ band with parasite egg nearby in the yolk.
3. Showing a *Chelonus* egg just previous to hatching in the yolk.
4. Showing a hatched *Chelonus* larva in the yolk just previous to the dorsal closure.



HISTOLOGY OF CHELONUS.

5. *Chelonus* egg thrust directly into the host embryo.
6. *Chelonus* egg placed in a similar position to that in No. 5, incubated 24 hours before sectioning.
7. *Chelonus* egg deposited in cephalic end of host embryo after final rotation.
8. Similar to No. 7 but with egg in caudal end.

VARIOUS NEW BUTTERFLIES (LEPID., RHOPALOCERA).

BY J. D. GUNDER,
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Eurymus meadii Edw. f ♀ **medi** new female form.

The white female of *meadii* Edw. without the typical burnt-orange color. Green of under sides, common character of black border maculation and rose tinted fringes and antennae as usual. The cell spot on the upper side of the secondaries is cream color and beneath it has the usual silver center.

Holotype—♀, expanse 44 mm.; Breckenridge Peak (11,000 ft.), Empire County, Colorado, Aug. 8, 1919. Type in Author's coll.

I am continuing to employ the generic name *Argynnis* Fabr. in place of *Dryas* Hbn. because there has been a lack of "published defense" in behalf of the latter name (and some others) as used in the Barnes & Benjamin Check List of 1926. Mr. F. H. Benjamin undoubtedly had and still has plenty of accumulated data in support of his use of certain Hubner names. I understand that presentation of his evidence has been held up. Perhaps it will be published.

Argynnis leto Behr, tr. f. **lethe** new tr. f.

Similar to *cybele baal* Stkr. Upper sides entirely black, except for a single, complete, submarginal row of white streaked spots which vary in size running through the limbal areas and several similar white spots external to the cell areas. On the under side of the secondaries, there is a concentration of silver spotting in the basal area and a partial row of submarginal silver spots, the ground color of the wing being brown and black; the primaries are generally black through the limbal area with suffused brownish-red and white design elsewhere, with the cell spots practically intact. *Classification*: change of pattern; melanifusism, near final phase of change and this type further advanced than the type of *baal* Stkr., photographs of which I have.

Holotype—♀, expanse 71 mm.; Big Horn Mts., Wyoming (E. J. Oslar, collector). Aug. 3, 1932. Type in Author's coll.

Argynnis edwardsii Reak., tr. f. **edonis** new tr. f.

Having the black maculation of the upper side primaries fattened and slightly fused inwardly, with the cell spots darker and enlarged. The upper side of the secondaries have the outer marginal design extra dark and there is a slight increase of thickness shown by all other design. On the under side of the primaries there is some enlargement of the usual black designs, while the secondaries show practically no change from typical. *Classification*: change of pattern; melanifusism, representing the start or primary phase of development.

Holotype—♀, expanse 68 mm.; Beaver City, Larimer County, Colorado (10-12,000 ft.), collected by Dr. C. P. Gillette on Aug. 1, 1892. Type from the collection of the Colo. Agri. College at Fort Collins, Colo., and received through the courtesy of Mr. S. C. McCambell, Associate Entomologist. Holotype to be placed in the Calif. Academy of Sciences at San Francisco.

Argynnis hennei new species.

Aside from *adiaste* Behr which does not enter into this discussion (and perhaps some stray records), there are *only* two *Argynnis* commonly found around San Francisco. One is *callippe* Bdv., (well illustrated by Oberthur and W. H. Edwards), occurring on the hills back of the city proper and for a short way south down the peninsula into San Mateo County, and the other is *coronis* Behr (well illustrated by W. H. Edwards) which according to Behr's own description "frequents several localities *near* the Bay of San Francisco" which includes the adjacent counties of Santa Cruz, Alameda and Santa Clara. My series (♂ & ♀) of *Argynnis* from Alma, Santa Clara County, which is the type locality of Skinner's *californica* shows that this name must fall as a synonym under *coronis*. Specimens from across the bay in the Oakland region are similar to those from Alma. Skinner cited the Edwards picture of *coronis* as illustrating his *californica*. *Argynnis lilliana* Hy. Edw. (well illustrated by W. H. Edwards) from St. Helena (Mt. St. Helena), Napa County, the type locality, which is north of the San Francisco Bay region, is quite a distinct butterfly and is not synonymous with any other. *Lilliana* is not found "near the Bay of San Francisco." Examples of *lilliana* in the Strecker Coll. at Chicago are *lilliana* all right, regardless of what labels they bear. I believe that W. H. Edwards had a better knowledge of the *Argynnis* and what their names meant than Strecker did of type localities and the "collecting of types." *Comstocki* Gun. is the southern California representative of the *callippe* group, being smaller and lighter above, and extending its habitat down even into San Diego County where the specimens run smaller. In order to correct in part recent *Argynnis* illustrations, I might state that on Plate 29 of Comstocks' 'Butterflies of California', his figs. 1, 2 and 3 represent *comstocki* Gun., not *callippe* Bdv.; his figs. 4, 5 and 6 represent *coronis* Behr, not *californica* Skin.; and his figs. 7 and 8 represent *lilliana* Hy. Edw., not *coronis* Behr.

For several years examples of an *Argynnis* have been collected by Dr. Comstock, Mr. Ireland, Lloyd Martin and others in certain regions north of Los Angeles off what is called the Ridge Route Highway. These have been tentatively placed as "a Calif. race of *snyderi*" or, for example, as "a southern race of *californica*." This year Mr. Chris Henne and myself made a determined effort to find a convenient, local metropolis for it and to get specimens in quantity. This we succeeded in doing on Mt. Pinos. *Hennei* flies there with *macaria* Edw. in the small, open 'meadows' and adjacent hill sides just down from the summit and at the summit near the one-way, steep mountain road. *Macaria* is quite common in comparison, while *hennei* seems to have an earlier emergence. Also *hennei* is a swifter and more energetic butterfly and harder to capture. An occasional *atossa* Edw. can also be taken on Mt. Pinos as well. This general region 'dries up' quickly with the coming of the California summer, so probably the best time for *hennei* is the last week in June and the first week in July, certainly not later.

Hennei approaches *semiramis* Edw. in appearance, but averages larger and has a more yellowish ground color (less reddish), more noticeable in the males. It differs from *coronis* Behr (synonym *californica* Skin.) in having much less black shading through the basal areas on the upper sides, much lighter tone

of color on both surfaces and by having a delicate or thinner character of general black maculation; also the outer marginal borders on the upper sides are heavier in *coronis* females. *Snyderi* Skin. from Utah (its type locality) is a larger butterfly and has a constant olive-greenish cast over its under side designs which is lacking in average *hennei*. All *hennei* which I have seen are well silvered, including the types, series from Mt. Pinos and several examples from Mt. Tehachapi in Kern County and from the Greenhorn Mts. of Kern County which adjoins the general Mt. Pinos district.

Holotype— ♂, expanse 55 mm., *Allotype*— ♀, expanse 60 mm.; near summit, elevation 7700 ft., Mt. Pinos, Frazier Mountain Park, Santa Barbara Nat. Forest, Ventura Co., Calif., July 10, 1933. Types in Author's coll., including one pair of paratypes (and general series), same place and date. One similar pair of paratypes in the Henne coll. Three ♂ paratypes in Comstock coll., Los Angeles Museum, dated June 10 and 13th, 1932, same locality, but lower elevation. One ♂ and one ♀ paratype in collection of W. H. Ireland of Taft, Calif., dated July 3, 1933. A long series of topotypicals is also in the Henne coll. from which he expects to supply examples to Washington and Ottawa.

Argynnis comstocki Gun., tr. f. **creelmani** new tr. f.

Upper side. Heavy dark suffusion of black design through discal and basal areas, starting just interior to the usual irregular, crenated band which crosses both wings. Submarginal area has typical designs though the marginal lines are extra heavy. Under side. The primaries show a slight repetition of the upper side changes, noticed by the thickening of the black transverse maculation; secondaries practically as usual. *Classification*: change of pattern; melanifusion, fairly well developed on the upper sides.

Holotype— ♂, expanse 48 mm.; East San Diego, California, June 13, 1933. Type in Author's coll. Named after Mr. J. Creelman of San Diego.

Brenthis aphirape dawsoni B. & McD., tr. f. **harperi** new tr. f.

The ground color all over, including the body, is yellow, instead of the typical reddish shade. Where the usual red shade of *dawsoni* is lighter in tone, the yellow of *harperi* is correspondingly lighter. The general maculation and silvering is unchanged. There is little question but that typical Churchill, Man., examples represent race *dawsoni* B. & McD., as the border maculation of the upper sides is heavier and the suffused connection between the submarginal row of spots and the border is apparent. Race *triclaris* Hbn. comes from Labrador; race *dawsoni* B. & McD. from north of the Great Lakes in Ontario; race *nichollae* B. & Benj. from the Canadian 'Rockies' and Alaska (I have Central Alaskan examples); and race *alticola* B. & McD. from Hall Valley, Colorado. *Classification*: change of color, chromatism, red shade to yellow shade.

Holotype— ♂, expanse 37 mm.; Churchill, Man., Canada, July 11, 1933. Type to be deposited in the Calif. Academy of Sciences according to the wishes of its collector, Mr. A. V. Harper of McCreary, Man. Specimen received through the courtesy of Mr. C. F. dos Passos of Mendham, New Jersey.

Brenthis helena ingens B. & McD., tr. f. **martini** new tr. f.

Upper side. A broad, black, irregular band completely crosses through the discal areas, formed by the confluence of the typical maculation in these areas. Cell spots enlarged, especially on the primaries. Marginal maculation

slightly heavier. Under side. As typical, though black designs are a little heavier. The type of *martini* is slightly smaller than usual *ingens*, series of which I have. *Classification*: change of pattern; melanifusism, a primary phase as evinced by similar tr. fs. in other species.

Holotype—♂, expanse 48 mm.: Teton trail, Teton Mts., Teton County, Wyoming (just south of the *ingens* type locality), July 8, 1931. Type in Author's coll. Named after Mr. Lloyd Martin of Roscoe, Calif., who received the example from Mr. Wind, its collector.

Euphydryas anicia Dbldy. & Hew., race **hopfingeri** new race.

Typical species *anicia* D. & H., as found around Banff, Alberta, Canada, which is its conceded type locality, is a rather dark reddish looking butterfly with heavy black maculation and its white designs are not much in evidence. Race, *hopfingeri* averages the same size, but is of a brighter red color, due to less heavy black design; extended white design in comparison, the rows of white spotting being definitely represented and the white submarginal crescents being clearly defined. The females are more of a rose-red and show up the white designs better than the females of *anicia*. Race *hopfingeri* is the first of the *anicia* group to be found in Washington or for that matter in our northwestern coast *States*. Race *windi* Gun. from the Teton region, just south of Yellowstone Nat. Park, is orange-red in ground color with not much red design above, while race *eurytion* Mead. from Colorado runs into the heavy, dark, blurred pattern. I have a pair of what must be *helvia* Scud. from White Horse, Alaska, and they differ from both *hopfingeri* and *anicia* by having the submarginal white (and red) spotting on the upper sides, round, not pointed or crescent shaped. The under sides of *hopfingeri* are about as in *anicia*, except that there is more white design on the disk of the primaries. *Hopfingeri* has a definite *anicia* style of male genitalia. When I first received the specimens from Mr. Hopfinger, I mistook them to be *paradoxa* McD. or a branch of that group; however *paradoxa* (from Lillooet, B.C.) belongs in the *chalcedona* category, both by genitalia and general superficial appearance. Mr. C. W. Herr took long series of *paradoxa* for me at Lillooet several years ago, and there is no question but that *paradoxa* leans strongly towards the *chalcedona* branch in the genus *Euphydryas*. Near Brewster, Washington, and adjacent counties, Mr. Hopfinger takes another *Euphydryas*, more generally at higher altitudes, which might be termed smaller *colonia* Wgt. These belong in the *editha* group by genitalia and appearance. As stated above these are smaller, darker, and have the rounded fore wings. Race *hopfingeri* Gun. should be catalogued just below race *helvia* Scud. in the *Euphydryas* check list of pl. 16, in the July, 1929, *Pan-Pacific Entomologist*.

Holotype—♂, expanse 37 mm.; allotype—♀, expanse 45 mm.; Black Canyon, Methow Valley, Okanogan County, Washington, May 28, 1933. A series of 15 ♂ and 15 ♀ topotypes and above types in Author's coll. Named after that ardent Washington collector, Mr. J. C. Hopfinger of Brewster, Washington.

Euphydryas anicia hopfingeri Gun., tr. f. **andersoni** new tr. f.

All rows of white spotting on both upper and under sides fused together through the interspaces forming a broad light band across the wings after the fashion of *chalcedona fusimacula* Barnes and others. Marginal red spotting as usual. Cell and basal areas on upper surfaces wholly dark with red cell spots

conspicuous. Looks like figs. 9 and 9a of tr. f. illustrated on pl. a in the July, 1928, Canadian Entomologist. *Classification*: change of pattern; albifusism, quite well developed, though not of the final phase as is possible.

Holotype— ♀, expanse 43 mm.; Black Canyon, Methow Valley, Okanogan County, near Brewster, Washington, May 28, 1933. Type in Author's coll. Named after Mr. Andrew Anderson of Pateros, Washington, a collecting partner of Mr. J. C. Hopfinger of Brewster, Washington.

Euphydryas anicia wheeleri Hy. Edw., tr. f. **duncani** new tr. f.

All the ground color of the wings including the body parts are yellow instead of the usual red or reddish-brown. Black maculation unchanged. *Classification*: change of color; chromatism, red through to yellow.

Holotype— ♂, expanse 40 mm.; Santa Catalina Mts., Arizona, April 12, 1933. Collected by Mr. D. H. Duncan of Globe, Arizona, after whom it is named. Type in Author's coll.

Note. Wheeleri seems to average about the same through northern and southern Arizona as to color and pattern. Examples from Zion Nat. Park in Utah also do not show much difference from those termed *wheeleri* from Nevada localities, as are known and collected over. I would like to compare central Nevada material however. All this Great Basin seems to produce a characteristic fauna. Lack of transverse design on upper side secondaries in *wheeleri* does not seem to be a constant factor, though southern Arizona material tends to show this. *Hermosa* Wgt. is a somewhat local Arizona race. I might add that some *wheeleri* approach *morandi* in color, yet *morandi* is entirely without a reddish tone.

Euphydryas editha wrighti Gun., tr. f. **thornei** new tr. f.

All rows of white spotting on upper side of primaries fused together, leaving cell spots and marginal red border unchanged; only a slight tendency to similar fusing is found on the under side. Both surfaces of the secondaries near typical with only a slight darkening through the basal areas of the upper side. *Classification*: change of pattern; albifusism, part development, especially on upper side primaries.

Holotype— ♀, expanse 45 mm.; Chula Vista, San Diego, Calif., March 9, 1930. Type in Author's coll. and named after Mr. Fred Thorne of San Diego who secured the type.

Euphydryas editha lehmani Gun., tr. f. **caverna** new tr. f.

Having the first two submarginal rows of white spots on both upper and under sides fused together into a complete, elongated, submarginal row. Typical otherwise. *Classification*: change of pattern, albifusism, a primary phase of development only.

Holotype— ♀, expanse 42 mm.; Mt. Wheeler, White Pine County, Nevada. Collected by Frank Morand. Type in Author's coll. Found near the Lehman Caverns, June 8, 1929.

Melitaea sterope Edw., tr. f. **hopfingeri** new tr f.

Primaries. On the upper side, the two submarginal rows of brown spots are fused together; likewise the brown spots through the discal area which makes these spots into a row of elongated, brown dashes, the cell spots remaining unchanged and likewise the narrow marginal border. On the under side, the

whitish-yellow pattern is elongated into long white dashes, while the cell area along the costal margin is heavily darkened. *Secondaries*: On the upper side, the basal and discal areas are solid, jet black, except for a single, brown, crescent spot in the cell; the outer third of the wing has the remains of two submarginal rows of brown spots nearly obliterated by black. On the under side there is an almost complete fusing of the white designs into a wide band clear across the wing. Some extra black spots appear in the cell and basal areas. *Hopfingeri* looks like tr. f. *pearlae* Gun. of *Melitaea acastus* Edw. as illustrated in the *Entom. News.*, pl. 1, fig. 7, Jan. '26. *Classification*: change of pattern, albifusism, almost a final phase of change.

Holotype— ♂, expanse 35 mm.; Aster Island (Columbia River), near Brewster, Okanogan County, Washington, May 14, 1933. Type in Author's coll. Named after Mr. J. C. Hopfinger of Brewster, Wash.

Note. Mr. Hopfinger was kind enough to collect for me about 15 ♂ and 15 ♀ of *sterope* Edw. The males are as W. H. Edwards describes, a dark brown color and the females invariably have a *black* ground color above which stands off the white maculation very strikingly. Sometimes this white maculation is touched with a brownish tone. In size *sterope* equals that of *gabbii* Behr or *whitneyi* Behr; they do not quite average the size of *palla* Bdv. however. The white color of *sterope* is a chalk white. Holland illustrates a ♀ *sterope*, but the example is probably not one of the Hy. Edwards specimens from which the description was originally made. His illustration shows the comparison to a ♀ *palla eremita* Wri. It is unfortunate that Leussler did not have Washington *sterope* or make any reference to it when he described his Washington and Oregon examples of *hewesi* (Entom. News, Jan. 1931) and I am afraid that *hewesi* must fall as a synonym as I have paratypes of it and they are the same as *sterope*. Mr. Hopfinger also takes *Melitaea hoffmanni segregata* B. & McD., near Brewster, Wash.

Phyciodes gorgone Hbn., tr. f. **thornei** new tr. f.

Upper Side. On the primaries, the row of brown spots through the limbal area is elongated inwardly and the brown color of the cell area extends outwardly. A row or line of grey scales appear just in from the marginal area and there is a grey cast over much of the black maculation along the costal margin. On the secondaries, the usual submarginal crescents disappear and all brown design through the discal area is fused inwardly to a black band around the cell; basal area becomes brown with simply a black spot showing; a short submarginal row of grey scales appear at the anal angle. *Under Side.* On the primaries, the color tone is decidedly mottled grey, there being no clear-cut design in black in the disk of the wing, only a brown area. On the secondaries, a very wide band of grey extends through the discal area, while the limbal and basal areas are simply a darker grey without design. The typically elongated spot found just opposite the cell near margin is shaped as usual, but of simply a brighter grey color. The under surface in general shows little if any of the typical yellow shading of ground color. *Classification*: change of pattern; albifusism, well developed, but not quite final.

Holotype— ♂, expanse 27 mm.; Chula Vista, San Diego Co., Calif., Oct. 11, 1933. Type in Author's coll. Collected and named after Mr. Fred Thorne

of San Diego.

Note. Tr. f. *nox* Gun. (Can. Ent. LX, p. 167, July, 1928) represents melanifusism; its type is in the Barnes coll. at Washington, while two other similar examples are in the Author's coll.

Atlides halesus Cram., tr. f. **corcorani** new tr. f.

A touch of red color is found on typical *halesus* at the base of the wing on the under side of the primaries, also two similar spots are so located on the secondaries. The under side of the abdomen is red as well. In *corcorani* these areas are a whitish-cream color. *Classification*: change of color; chromatism, red to probably yellow (not white).

Holotype—♂, expanse 31 mm.; Riverside, Riverside County, Calif., Sept. 2, 1933. Type in Author's coll. and named after Mr. J. A. Corcoran of Los Angeles who captured the example.

ANNOTATED CHECK LIST OF THE MACROLEPIDOPTERA OF ALBERTA—ADDITIONS AND CORRECTIONS.

BY KENNETH BOWMAN,

Edmonton, Alberta.

The following additions and corrections bring my "Check List of the Macrolepidoptera of Alberta" up to date. The changes in the Eupithecias are based on Dr. McDunnough's revision which appeared in the "Canadian Entomologist," Vol. 61, p. 59.

35	*Pieris napi marginalis* Scud.	6 7	Bm.B.N.W.
46	*Anthocharis sara stella* Edw.	6	Bm.W.
68	*Eurymus palaeno chippewa* Edw.	6	Fort Vermilion
103	*Coenonympha inornata benjamini* McD.	6 7	W.C.N.E.R.B.Bm. H.
403	*Heodes editha* Mead.	8	Lesser Slave Lake
1420	*Agrotis opacifrons* Grt.	4 5+7-9	E. R.
3012	*Sarrothripus revayana cinereana* N.&D.	4 5	E.
4145	*Eupthecia filmata Pears.*	6	R.N.
4157	" *luteata* Pack.	7 8	E.C.N.
4169	" *geminata* Pack.	7	E.
	" *pygmaeata* Hbn.	8 9	P.B.N.L.
	" *sobrinata* Hubn.	6	W.
	" *silenata* Stndfs.	6 7	N.E.P.
	" *innotata* Hufn.	5 6	E.N.Bm.R.
	" *satyrata* Hbn.	4 5	C.
4207	" *annulata* Hulst.	6 7	L.N.P.
4203	" *gelidata* Moesch.	7	W.N.
4237	" *bryanti* Tayl.	8	E.Lb.
4374	*Phasiane hebetata decorata* Grossb.	7 8	B.N.
N.S.	*Enypia moillieti* Blackmore	9	E.
4630	*Cingilia catenaria* Dru.	5 6	E.
4687	*Gonodontis warneri* Harv.		

Delete

35 *Pieris napi pseudonapi* B. & McD.=*marginalis* Scud.

50 *Eurymus hecla hela* Stkr.

This was recorded from a single specimen taken at Banff which in Dr. McDunnough's opinion is probably a hybrid between *E. nastes* Bdv. and *E. meadi elis* Stkr.

46 *Anthocharis sara julia* Edw.=*stella* Edw.
103 *Coenonympha inornata* Edw.=*benjamini* McD.
4171 *Eupithecia casloata* Dyar.
4148 " *obumbrata* Tayl.=*pygmaeata* Hbn.
4172 " *niphadophilata* Dyar=*sobrinata* Hubn.
4185 " *scelestata* Tayl.=*silenata* Stndfs.
4189 " *alberta* Tayl.=*innotata* Hufn.
4193 " *dodata* Tayl.=*satyrata* Hbn.
4274 " *fumata* Tayl.=*satyrata* Hbn.
N.S. " *mackieata* Cass. & S.=*satyrata* Hbn.
N.S. " *divinula* Cass. & S.=*satyrata* Hbn.
4197 " *limnata* Pears.=*annulata* Hlst.
4180 " *lagganata* Tayl.=*gelidata* Moesch.
N.S. " *nordeggensis* Cass & S.=*gelidata* Moesch.
N.S. " *inclarata* Cass. & S.=*nimbicolor* Hlst.
4194 " *adornata* Tayl.=*nimbicolor* Hlst.

NOTES ON FRANCIS WALKER'S TYPE-SPECIMENS OF NORTH AMERICAN ANTHOMYID FLIES IN THE BRITISH MUSEUM. (MUSCIDAE, DIPTERA).

BY H. C. HUCKETT,
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The first extensive contribution to a knowledge of the anthomyid flies of North America was made by Francis Walker in 1849[1], when he published the records of fifty-five nominal species in his list of dipterous insects in the British Museum. Of these species thirty-four were collected by G. Barnston at St. Martin's Falls, Albany River, Hudson Bay, located at longitude 86.30, latitude 51.30[2]; eighteen by Lieutenant Redman in Nova Scotia; one from Florida, and two from "N.A." Seven years later a second contribution was made by Walker, when he published the descriptions of ten nominal species from specimens in the collection of William Saunders recorded from "U.S.".[3]

Largely owing to the stereotyped form used by Walker to describe these species, to the generalized grouping of the species into a few genera, and to the fact that the species are frequently represented by females, which sex is notoriously lacking in diagnostic characters, our knowledge of their identity has been regretably incomplete. Stein[4] attempted to elucidate the species in 1901, and gave valuable information regarding their generic and specific relations, but many he failed to recognize.

Through the courtesy of Major E. E. Austen and Miss D. Aubertin of the British Museum I had the privilege of examining the Walker collection, and found the specimens in such condition as to be invariably capable of recognition.

1. Walker, List Dipt. Brit. Mus. 1849 IV. 923-972.
2. Aldrich, Misc. Coll. Smithsn. Inst., 1905 XLVI. No. 1444 66.
3. Walker, Ins. Saund., Dipt., 1856 I. 350-369.
4. Stein, Zeitschr. f. Hymen. u. Dipt., 1901 I. (4) 185-221.

The fact that most of the so-called types are females is unfortunate but not a serious obstruction to final identification. The collection was evidently in very much the same condition as when Stein examined it in July 1900. Previously Waterhouse had evidently carefully labelled and assembled the collection, since many of the specimens retain such notes as, "one of Walker's series so named, E.A.W." or, "does not agree with Walker's description, E.A.W., 28. V.00."

The following notes on Walker's species in the British Museum are offered in the hope that they may contribute to a more complete knowledge regarding the identity of specimens of such basic interest to students of North American Muscidae.

I was unable to find specimens representing *Eriphia lamnia, Lispa hispida, Spilogaster terminalis, Coenosia solita.*

Eriphia acela Walker, (List, 962), a female of *Lispa tentaculata* (DeGeer). Both mid and hind legs are missing in the type specimen.

Anthomyia acra Walker, (List, 951), a female of *Fannia manicata* (Meigen).

Anthomyia aemene Walker, (List, 937), type a female belonging to the genus Hylemyia. The species was described by Stein as *Hylemyia testacea,* and structurally closely resembles *H. depressa* Stein.

Anthomyia alaba Walker, (List 948), a species described by Malloch as *Hylemyia innocua.* The type specimen is headless, but is readily recognised by the striking appearance of the long curling bristles on the cerci (upper forceps) of genitalia. The species is to be associated with those having a short stout blunt apical bristle on posteroventral surface of fore tibia, and may further be recognised by the few shortish bristles on dorsum of mid basitarsus and the uniform development of the anterodorsal bristles of hind tibia, none of which are longer than breadth of hind femur.

Anthomyia alcathoe Walker, (List, 937), a species described by Bigot as *Hylemyia flavicaudata,* and is the same as *Hylemyia strigata* Stein and *H. tenax* Johannsen.

Anthomyia alone Walker, (List, 941), the female type resembles *ausoba,* of which it has usually been considered a synonym. However there are peculiar differences between the two species which I believe to be at least of varietal significance. In *alone* the fore femur has a longish patch of blackish infuscation restricted to the posterodorsal surface, the hind femur has 3 or 4 preapical bristles across the dorsal half, the parafacials and cheeks are broader and higher respectively, and the arista is shorter haired than in the case of *ausoba.* In *ausoba* the fore femur is entirely yellowish and the hind femur has 2 preapical bristles across dorsum, namely the distal bristle of anterodorsal and dorsal series.

Anthomyia anane Walker, (List, 927), a species belonging to the genus Hylemyia, and which I am unable to recognise with certainty, largely owing to the fact that it is only represented in the female sex and the specimen is not in the best of condition. It comes nearest to *Hylemyia setigera* Johannsen and *H. inornata* Stein. I present herewith a few descriptive notes.

Head with parafrontal bristles in a broken series, 3 + 4; parafacials, in profile, fully as wide as breadth of third antennal segment; cheeks as high as length of third antennal segment; arista densely pubescent, longest hairs about three times as long as diameter of arista at base; parafacials with a dark brownish

fascia at base of antennae; second antennal segment with a tinge of reddish along distal margin; proboscis narrow and flattish laterally, with trace of pruinescence.

Mesonotum brownish cinereous, with median vitta; acrosticals setulose, irregularly paired; pra long and strong. Wings yellowish, densely so basad; costal thorns longish, robust, costa with a series of longish semierect bristles proximad, and with a series of shorter bristles distad of costal thorns.

Abdomen concolorous with mesonotum, nonvittate, nearly equal in length to that of head and thorax combined; marginal bristles of terga moderately developed. Fore tibia with 2 anterodorsal and 1 mid posteroventral bristle; mid legs missing; hind femur with a series of 4 well developed bristles on distal two-thirds of anteroventral surface, which are but slightly, if any, longer than width of femur, with 3 or 4 finer bristles on proximal half of posteroventral surface; hind tibia with 2 anteroventral, 4 anterodorsal, 4 posterodorsal bristles, with no setulae evident on posterior surface, with apical posterodorsal bristle well developed and with apical posteroventral bristle not strongly developed. Length, 6.5 mm.

Coenosia antica Walker, (Ins. Saund., 367), a male of *Bithoracochaeta leucoprocta* (Wiedemann). The specimen has the hind legs missing.

Anthomyia apina Walker, (List, 927), a female of *Prosalpia silvestris* (Fallén). The original description calls for a male and female, but the former sex is not represented.

Eriphia arelate Walker, (List, 961), a female of *Prosalpia billbergi* Pokorny. Walker was evidently in error in designating the specimen a male. The female is noticeable on account of the shining dark thorax and abdomen, with little trace of pruinescence. Further descriptive notes follow.

Eyes separated by a distance fully as wide as breadth of third antennal segment; cheeks about as high as, and parafacials wider than breadth of third antennal segment, the latter 1.25 times length of second segment; arista naked. Thorax with 2 or 3 pairs of longish, fine, presutural acrosticals, in two narrowly separated series; pra long. Abdomen subovate, depressed, the fifth tergum is abruptly pointed caudad, the caudal margin being deeply cleft at middle of dorsum. Fore tibia with 2 anterodorsal and 2 posteroventral bristles, with all apical bristles robust except apical posterodorsal bristle; fore tarsal segments 2, 3, and 4, compressed dorsoventrally, being slightly broader than basitarsus, but not as broad as those of *silvestris*. Mid femur with 5 or 6 uniformly developed bristles on proximal two-thirds of anteroventral surface, posteroventral surface with a series of 5 longer bristles on proximal half; mid tibia with 2 anteroventral, 2 anterior, 2 anterodorsal, and 3 posterior bristles.

Hind femur with a series of 10 to 12 uniformly developed bristles on anteroventral surface, which are scarcely longer than breadth of femur, posteroventral surface with a series of 5 longer bristles on proximal two-thirds; hind tibia with a series of 6 or 7 anteroventral bristles, 2 of which are situated ventrad and are weaker developed, with 4 or 5 anterodorsal, 4 or 5 posterodorsal, and with 1 mid posterior bristle, apical bristles robust.

Coenosia atrata Walker, (Ins. Saund., 369), a species described by Stein as *Coenosia canescens,* and which in the literature has been recorded in error as

Coenosia lata Walker. The mid legs and abdomen are missing from the female specimen, but there remains no doubt in my mind regarding the correct identity of the species.

Coenosia ausoba Walker, (list, 938), a species described by Stein as *Coenosia aurifrons,* and of which *alone* (List, 941) is at present considered a synonym despite certain marked differences in chaetotaxy and coloration.

Anthomyia badia Walker, (List, 950), a species belonging to the genus Hylemyia, and which I am unable to associate with others that I have seen. The type is a female and agrees in many respects with that of *Hylemyia brevitarsis* Malloch, in common with which it possesses the following characters.

Eyes with a few hairs; parafacials prominent, fully as broad as width of third antennal segment; cheeks slightly narrower; second antennal segment dark seal brown, third segment slightly longer than broad; arista almost bare; proboscis narrow, polished. Thorax with acrosticals short, in two closely adjacent series, posthumeral bristle duplicated, pra long, posterior notopleural bristle short, scarcely equal to half length of anterior bristle, mesonotum with traces of five vittae. Abdomen with brownish marks, vitta and posterior incisures, all of which are rather indefinite. Fore tibia with 1 anterodorsal, 1 posteroventral, and with a well developed apical posterodorsal bristle; mid femur with a stoutish bristle at one third from base on anteroventral surface, and with a shorter bristle proximad; posteroventral surface with a series of bristles on proximal two-thirds; mid tibia with 1 anterodorsal, 2 posterodorsal, and 2 posteroventral bristles; hind femur with a series of bristles on distal three-quarters of anteroventral surface, and on proximal two-thirds of posteroventral surface; hind tibia with 2 anteroventral, 4 anterodorsal, 3 posterodorsal bristles, with apical anterodorsal and posterodorsal bristles of equal size, with apical posteroventral bristle absent. One of the mid tibiae has a weak mid anteroventral bristle. Length, 5.5 mm.

Anthomyia barpana Walker, (List, 933). Walker's description calls for a female specimen with black halteres. The so-called type specimen under *barpana* is a male with yellow halteres. As indicated by Stein[5] I believe the specimen to be identical with Schnabl's (*Helina*) *van der wulpii.* The species has hairs along the ventral margin of scutellar declivities, the hypopleura and prosternum are bare, eyes are densely hairy, cheeks deep, as high as length of third antennal segment, first abdominal sternum bare, hind femur with a complete series of anteroventral bristles, those on proximal half finer developed, posteroventral surface with a series of fine longish bristles on proximal half, longer than those on anteroventral surface and becoming tufted basad, the distal half with a series of uniformly short fine bristles. Otherwise the species is as described by Stein.[6]

Eriphia biquadrata Walker, (List, 963). I have come to the conclusion that this species along with *Sphenomyia banffi* Seamans, *S. kincaidi* Aldrich, *Limnophora nitidifrons* Stein, and possibly *L. ophyraeformis* Karl represent the same species, and are synonymous with *Limnophora leucogaster* (Zetterstedt). I have examined a number of specimens of *leucogaster* in European collections, and find that some of them possess one or more setulae toward base of vein *R.* 4 + 5, and

5. According to Stein's notations on specimens in the Zoological Museum of the University of Berlin.

6. Stein, Zeitschr. f. Hymen. u. Dipt., 1901 I (4) 188.

some do not. There is also a great variation in size of specimens and in coloration of halteres from yellow to purplish black.

Anthomyia brixia Walker, (List, 946). The female type agrees in most particulars with that of *Eustalomyia histrio* (Zetterstedt), with which I believe it to be identical. The aristal hairs are not longer than diameter of arista at base; the parafacials are as broad as three-quarters length of third antennal segment; cheeks as high as length of third antennal segment; posterior notopleura bristle short; fifth abdominal tergum largely blackish infuscated; hind femur with an entire series of anteroventral bristles.

Anthomyia bysia Walker, (List, 936). There are two specimens under this name, as indicated by Stein. The female type is the true *Phaonia bysia* (Walker), the other female specimen is identical with those of *Pegomyia connexa* Stein.

Eriphia ciliata Walker, (List, 961). The male type is identical with *Egle muscaria* (Fabricius).

Anthomyia communis Walker, (Ins. Saund., 366). The female is the same as that of *Euryomma peregrinum* (Meigen), and has been described by Stein as *E. hispaniense.*

Dialyta cupreifrons Walker, (List, 966). A headless female of what I take to be the same as *Hylemyia cilicrura* Rondani.

Anthomyia despecta Walker, (Ins. Saund., 364). The female type, which is headless, was taken in Brazil. The species agrees in all particulars with *Bithoracochaeta leucoprocta* (Wiedemann), a species occurring in the States bordering the Atlantic Ocean and Gulf of Mexico.

Anthomyia determinata Walker, (List, 954). Female type identical with *Egle muscaria* (Fabricius).

Anthomyia donuca Walker, (List, 946). Three female specimens, including the type, all of which are the same as *Prosalpia silvestris* (Zetterstedt).

Eriphia flavifrons Walker, (List, 966). The female type has the hind legs missing, but despite this I am of the opinion that the specimen is a female of *Pegomyia fringilla* Malloch. Notes on the type follow:

Head with cheeks, parafacials, and cephalic part of frons yellowish to reddish; face grayish black; palpi fuscous, paler basad: thorax and abdomen concolorous, blackish with light grayish dust, the latter with trace of brownish vitta. All femora entirely blackish; fore and mid tibiae rufous. Antennae blackish except for apical border of second segment, which is yellowish. Proboscis polished. Arista minutely pubescent. Pra short; posthumeral bristle not duplicated: fifth tergum with a few erect short discal bristles. Fore tibia with 1 anterodorsal and 1 posterior bristle, apical posterodorsal bristle setulose: mid femur with 1 or 2 weak bristles on proximal third of posteroventral surface; anteroventral surface with no bristles, anterior surface with a preapical bristle; mid tibiae with 1 anterodorsal, 1 posterodorsal, and 2 posterior bristles. Length, 5 mm.

Anthomyia geldria Walker, (List, 940). The male type specimen, which I believe to be the basis of Walker's description despite the fact that he designated the sex a female, is in poor condition, consisting of the thorax, wings, fore, mid, and hind legs. The female specimen is in good condition. The species is none other than *Lasiops diaphanus* (Wiedemann), and was again described by Walker on the previous page in his list as *Anthomyia signia.* The specimens of *geldria*

differ from that of *signia* in lacking a weak anteroventral bristle on mid tibia.

Eriphia grisea Walker, (List, 962). The species is the same as *Prosalpia silvestris* (Fallén).

Anthomyia idyla Walker, (List, 948). The female type is I believe identical with females of *Hydrotaea acuta* Stein. The species closely resembles *Hydrotaea occulta* (Meigen) in the female sex, differing in that the mid tibia has only two posterior bristles, and the hind tibia 1 or 2 anteroventral bristles. The jowls possess a single upcurved bristle, and the frontal triangle is entirely polished.

Anthomyia incerta Walker, (Ins. Saund., 354). There are two specimens under this name both labelled *incerta* in Walker's handwriting, and both from the "U. S.". The male specimen fits the description, and is undoubtedly the same as *Spilaria lucorum* (Fallén). The second specimen, which has evidently been misplaced, is a female of *Coenosia atrata* Walker (= *C. lata* of authors).

Coenosia intacta Walker. There are two specimens under this name, both with Walker's manuscript label *"intacta"*. The male was evidently described in the Transactions of the Entomological Society of London, 1860 V p. 318, and is identical with the species *Lispocephala erythrocera* (Robineau-Desvoidy). The other specimen is a female, and was evidently described in *Insecta Saundersiana*, 1856 p. 369, under the same name. This species belongs to the group Hoplogaster, and may be readily recognised by the peculiar spinular development of the first pair of dorsocentral setulae of the thorax, the setulae on the humeral calosities, and of the propleural bristles.

Anthomyia isura Walker, (List, 952). The type is a female of *Fannia canicularis* Linnaeus.

Eriphia lata Walker, (List, 963). The female type is similar to that of *Anthomyia idyla* Walker, and represents, in my opinion, the species described by Stein as *Hydrotaea acuta*.

Coenosia lata Walker, (Ins. Saund., 368). There are two female specimens under this name, one labelled *"lata"*, and the other *"intricata"* in Walker's handwriting; both specimens are however conspecific, and agree perfecty with the female characters of *Coenosia hypopygialis* Stein.

Anthomyia lipsia Walker, (List, 928). The species belongs to the genus Pegomyia, and may be readily distinguished in the female sex by the distinctive black streaks along the lateral margins of disc of mesonotum, when viewed from behind, and by the broadened third and fourth segments of fore tarsi. The species was again described by Walker as *Coenosia substituta*, and by van der Wulp as *Hylemyia tarsata*.

Anthomyia luteva Walker, (List, 934). Two females of which the type specimen has the fore femora missing. The species is undoubtedly the same as *Phaonia errans varipes* (Coquillett), having the femora more or less infuscated.

Anthomyia lysinoe Walker, (List, 938). Three males, which agree in every important respect with *Helina amoeba* (Stein), having the abdomen largely reddish yellow. In two of the specimens, including the type, the humeral callosities are yellowish. Undoubtedly these are the males of *Anthomyia troene* Walker.

Eriphia marginata Walker, (List, 964), a female of *Hylemyia cilicrura*.

Anthomyia narina Walker, (List, 933). There are four specimens under this name. Three females represent *narina*, a species which has been described in the

the male sex as *Limnophora brunnesquama* Malloch, and *L. nigrifrons* Stein. The sexes are strongly dimorphic.

Anthomyia narona Walker, (List, 945). Two males from Florida, both of which are typical of the species as it occurs in that locality. The calyptrae are brownish infuscated, and the mesonotum is deeply tinged with seal brown infuscation. The species belongs to the genus Limnophora, and has been described as *L. cyrtoneurina* Stein. Walker designated the sex a female, but in this he is in error, as his description indicates.

Anthomyia nigra Walker, (List, 931), female type similar to that of *omole* and *similis*, all three of which I consider identical with females of *Muscina assimilis* (Fallén).

Anthomyia nigrifrons Walker, (List, 932). The female type is similar to *Lasiops spiniger* (Stein), with which I believe it to be identical.

Anthomyia nigripennis Walker, (List, 929). The species has been described as *Helina nitida* (Stein), being readily recognised by the widely separated eyes in the male, the black halteres, and blackish margin to the calyptrae. Walker gives the sex as a female, no doubt being mislead by the widely separated eyes.

Anthomyia omole Walker, (List, 930), a female of *Muscina assimilis* (Fallén), and redescribed by Walker as *A. omole* and *A. similis*.

Anthomyia opalia Walker, (List, 956), a synonym of *Ophyra leucostoma* (Wiedemann).

Anthomyia palposa Walker, (List, 926). The type is a male, and not a female as given by Walker, and although the description calls for no bristles on the side of the face there are a few "bristles" on ventral half of parafacials, such as is mentioned by Walker in the description of *Eriphia acela* (=*Lispa tentaculata*). The male of the species may be readily recognised by the blackish, broadly spatulate palpi, blackish hateres, black velvety bar on parafacials at base of antennae, and by the chalk white triangular spot on caudal segment of abdomen. The same species was described by Stein as *Lispa nigromaculata*.

Anthomyia perrima Walker, (List, 950). The male type is identical with specimens of *Hylemyia cilicrura*.

Eriphia pretiosa Walker, (List 965). The female type is conspecific with that of *arelate*, a species which, in my opinion, was described by Pokorny as *Prosalpia billbergi*.

Aricia procedens Walker, (Trans. Ent. Soc. Lond., 1860, 315). A female from Mexico, which has been recorded from North America as *Helina uniseta* (Stein), with which I believe it to be identical.

Anthomyia pylone Walker, (List, 928). A synonym of *Spilaria lucorum* (Fallén), as indicated by the female type.

Anthomyia rugia Walker, (List, 923). The type is a male, and although Walker designated the sex as female his description is apparently that of a male specimen, as indicated by the stereotyped phrase used to describe the front. The specimen agrees in every particular with Malloch's diagnostic description of *Phaonia incerta*, with which species I believe it to be identical. Undoubtedly specimens that have been recorded heretofore as *Mydaea rugia* (Walker) are misidentifications.

Coenosia sexmaculata Walker, (List, 970). The male specimen under this name has no type label, but a note to the effect that the specimen does not agree with Walker's description. This differs chiefly in the sex represented, in having the arista bare, the thorax trivittate, and the tarsi black. The specimen has the arista pubescent, the thorax unmarked, and the tarsi largely yellowish, as the tibiae. Although the species does not readily conform in coloration and markings to what I have usually seen in *Coenosia tigrina* (Fabricius), yet there are no differerences in chaetotaxy and structure that would warrant my regarding it as any other than that species. Whether this was the specimen on which Walker based his description of *sexmaculata* I am unable to say.

Anthomyia signia Walker, (List, 939). The female type resembles the female specimen under *geldria,* both of which I consider to be examples of *Lasiops diaphanus* (Wiedemann). In *signia* the abdomen is more extensively blackened than in *geldria,* and the mid tibia has a weak anteroventral bristle, which is lacking in *geldria.*

Anthomyia similis Walker, (List, 930). Two female specimens, of which the type is identical with *Muscina assimilis* (Fallén).

Anthomyia simillima Walker, (List, 972). A female type, which is conspecific with the male type of *Lispa palposa* (Walker).

Anthomyia soccata Walker, (List, 941). The species is represented by the female type, which belongs to the genus Phaonia. Malloch[7] has fully redescribed the species.

Anthomyia solita Walker, (Ins. Saund., 354). The male type is a specimen of *Spilaria lucorum* (Fallén), agreeing in all respects.

Anthomyia spinosa Walker, (List, 926). The types are identical with the species *Helina latifrontata,* Malloch, which may be readily recognised by its shiny black appearance, stout bristling, broadly separated eyes, plumose arista, long prealar bristle, with no mid bristle on fore tibia, with no bristles on posteroventral surface of hind femur, and with 3 or 4 bristles on posterior surface of hind tibia.

Coenosia spinosa Walker, (List, 967). The female specimen under this name has no type label, but has a note to the effect that the specimen does not agree with Walker's description. This differs chiefly from the specimen in stating the legs to be yellowish instead of blackish. The specimen belongs to the genus Hylemyia, but without the male sex being represented I am unable to satisfactorily link it up with allied forms. Descriptive notes follow. Length, 6.5 mm. Bristling of the head stoutish; parafacials at base of antennae nearly as wide as breadth of third antennal segment; cheeks narrower; second antennal segment seal brown; third antennal segment blackish, 1.25 times as long as wide; arista finely short pubescent; oral margin well flexed forward; palpi fuscous, proboscis polished, slender. Thorax with three broad blackish vittae, acrosticals setulose, pra longish; sternopleural bristles, 3 : 3; dorsal bristle of mesopleural series strongly developed. Abdominal pruinescence with large paired darkish areas laterad on caudal half of each terga; abdomen with a dorsocentral vitta. Fore tibia with 1 anterodorsal and 1 posteroventral bristle; mid femur with a series of short bristles on proximal half of posteroventral surface, anteroventral surface with a bristle basad; mid tibia with a stout anterven-

7. Malloch, Trans. Amer. Ent. Soc., 1923 XLVIII. No. 833 p. 259.

tral, 1 anterodorsal, 1 posterodorsal, 3 posterior, and 1 posteroventral bristle, the 3 posterior bristles situated proximad of antero- and posterodorsal, and posteroventral bristles; hind femur with a complete series of 8 or 9 anteroventral bristles, with a series of 4 or 5 posteroventral bristles on proximal half; hind tibia with 3 anteroventral, 5 anterodorsal, and 4 posterodorsal bristles, with no setulae evident on posterior surface, with apical posterodorsal bristle setulose, with apical posteroventral bristle not well developed; fifth tarsal segments ellipsoid, fully as long as third segment. Wings faintly tinged, cross veins faintly clouded; calyptrae tinged with yellow; costal thorns small. I am unable to say whether this is Walker's *spinosa* or not.

Coenosia substituta Walker, (List, 971). The species belongs to Pegomyia, the male type representing the same species as *Anthomyia lipsia* Walker.

Anthomyia tarsalis Walker, (Ins. Saund., 355). The species as represented by the female type is identical with *Lasiops latipennis* (Malloch).

The original description calls for a male specimen in addition, but I find none represented. Stein[8] regarded the specimen as a female Coenosia, but I am in doubt whether his description refers to the above specimen, since there are discrepancies between my notes and his regarding the chaetotaxy and presence or absence of certain of the legs. I find that of the femora and tibiae only a mid tibia and femur remain, whilst Stein stated that the middle leg is missing.

Anthomyia teate Walker, (List, 931). Type a female, which is in all important respects the same as females of *Hydrophoria brunneifrons* (Zetterstedt), and I believe of *H. proxima* Malloch. The latter species has the tibiae largely infuscated, but I find that this character varies in extent within the species, otherwise the specimens agree. The female type of *teate* has the fore tibiae infuscated on distal half, and the mid and hind tibiae entirely reddish yellow. In addition the type has four postsutural dorsocentral bristles which I consider to be abnormal for the species, the number usually being three, as is present in the second female specimen of *teate*.

Anthomyia tinia Walker, (List, 949). Type a female of *Hylemyia cilicrura*.

Anthomyia troene Walker, (List, 936). The female type is conspecific with the male type of *Anthomyia lysinoe* Walker, the former name having precedence over the latter. The females of *troene* show a variation in the extent of the grayish and yellowish color of the abdomen. In the type there is a short anterodorsal bristle on the mid tibia.

Anthomyia uxama Walker, (List, 948). The female type is similar to that of *Anthomyia acra* Walker, both being identical with *Fannia manicata* (Meigen). In the type of *uxama* the hind coxae have bristles on caudal surface; hind tibia with a series of anterodorsal setulae proximad of anterodorsal bristle, and with 2 or 3 anteroventral bristles: mid femur with a series of 4 or 5 bristles on median half of anteroventral surface, and with a weakish bristle at base of posteroventral surface; mid tibia with 1 anterodorsal and 1 posterior bristle, and with a well developed preapical dorsal bristle. Abdomen highly shining, blackish brown. Parafrontals of head grayish pruinescent, setulae descending to about level with base of third antennal segment. Palpi rather spatulate, and proboscis fleshy.

Anthomyia viana Walker, (List, 951). Type a female of *Hylemyia cilicrura*.

8. Stein, Zeitschr. f. Hymen. u. Dipt., 1901 1 (4) p. 213.

A NEW SPECIES OF THE GENUS INCISALIA (LEPIDOPTERA).

BY A. C. SHEPPARD,
Montreal, Province of Quebec.

On June 12th, 1932, while collecting along a roadway running through a large swampy area at Lanoraie, P. Q., on the north side of the St. Lawrence River and about forty miles east of Montreal, I obtained two specimens of the above genus, which on comparison with allied species could not be matched, these were later submitted to Dr. J. McDunnough at Ottawa, Ont., who kindly examined them for me and found that they did not seem to fit in with any of the species known to him but due to their rather worn condition it was suggested that I try to obtain some better specimens another year before making any definite determination of them. It was, therefore, decided to pay another visit to the swamp on May 21st, 1933, and I was fortunate in finding a male and female in almost perfect condition, a second trip was made on June 4th and a fifth specimen taken, rather worn, however. Specimens were again submitted to Dr. J. McDunnough who has very generously examined them again for me and reports that they represent an apparently undescribed species, for which I propose the following name:

Incisalia lanoraieensis n. sp.

Abdomen and thorax dark brown above, the former having a considerable number of ashen grey scales beneath, antennae dark brown ringed with white, the club tipped with rufous, basal third white beneath; eyes narrowly edged with white. Upper surface of wings dark brown, with a little red-brown near the anal angle of hind wings, sex-mark of the male consists of a small oval patch of greyish scales, fringes the same colour as the primaries, but are cut with a few white scales between the nervules, the secondaries are slightly produced at tips of the nervules but not tailed. Under surface of the primaries warmer brown with an irregular extramesial white stripe from the costa to vein 2 (M1) edged inwardly with dark brown, about midway between this and the outer margin a series of five small, distinct dark brown triangular spots pointing inwardly not more than one in any interspace, between these spots and the margin slightly hoary; at the outward extremity of the cell a short discal bar with a few lighter scales centrally and a further indistinct dark line crossing the cell in about the middle. Under surface of secondaries slightly warmer brown than the primaries, the basal half divided from the outer by an irregular broken white line, which projects outwardly, with the greatest projection between veins 2 and 4, edged inwardly with dark brown; the basal area is divided in half from costa to inner margin by a very dark brown, irregular, narrow band, the inner edge relieved by a few white scales near costa and inner margin, area from this line to base shading to dark brown, almost black; the outer half is crossed midway by a lunulate dark line, which is produced inwardly between each vein; between this line and a fine dark brown marginal line the interspaces between veins 1 and 6 were filled with ashen-grey scales, the two interspaces at anal angle containing small dark dots, slightly relieved on inward side by orange-brown scaling. Expanse 20-22 mm.

Holotype: ♂, Lanoraie, P. Q., May 21st, 1933, in the Canadian National Collection, Ottawa, Ont.

Allotype: ♀, Lanoraie, P. Q., May 21st, 1933, in author's collection.

Paratypes: 1 ♀, Lanoraie, P. Q., June 4th, 1933, 2 ♀ ♀, Lanoraie, P. Q., June 12th, 1932, in author's collection.

The type of underside maculation is somewhat reminiscent of that of *eryphon* Bdv., but the broad ashen terminal shading on hindwings along with the two anal dark dots and none of the pale lunate marks found in both *eryphon* and *niphon* are characteristic; the species is, furthermore, much smaller than *eryphon*.

A NEW TRICHOCHROUS (COLEOPTERA-MALACHIDAE)

BY H. C. FALL,

Tyngsboro, Mass.

Trichochrous calcaratus n. sp.

Of the usual elongate oblong form, about 2-2/3 times as long as wide, moderately convex; color black with faint greenish lustre, base of antennae, tarsi, and in the male the apex of the front tibiae dull rufous. Pubescence thin, not concealing the derm, consisting of sparse subrecumbent fulvocinereous hairs abundantly intermixed with suberect black setae over the entire surface; pronotal and elytral marginal fringe of longer erect black hairs which are not at all recurved. Integuments polished throughout.

Head 2/3 as wide as the prothorax; frontal impressions shallow, punctures fine and sparse. Antennae subserrate, fifth joint a little larger, 6-10 subtriangular, moderately transverse.

Prothorax a little less than one-half wider than long, slightly wider at base than at apex, widest just behind the middle, sides nearly evenly and rather strongly arcuate, a slight sinuation before the hind angles, which are sharply defined but obtuse; front angles scarcely defined, apex truncate, side margins minutely serrulate; surface uniformly and rather finely and sparsely punctate throughout.

Elytra barely perceptibly wider than the prothorax, very nearly twice as long as wide, sides straight and parallel, apex distinctly serrulate, sutural angles rounded; punctation evenly disposed, rather close and coarser than on the thorax.

Body beneath rather densely punctate and with oppressed pale pubescence.

Length 2.6 to 4. mm.; width .9 to 1.5 mm.

The above description is drawn from the male. In the female the head, antennae and thorax are all relatively slightly smaller. In the male the fifth ventral is truncate and feebly emarginate at apex; the protibiae are armed at tip with a single long rather stout acute spur, the middle tibiae with a broad obtuse laminiform inner spur and apparently a slender acute outer one in close juxtaposition, but the structure is difficult to make out; the hind tibiae have a slender acute spur which is not longer and but little stouter than the terminal spinules. In this sex also the apex of the basal joint of the hind tarsus is extended beneath in a long acute spiniform process which is finely bifid at tip. In the female the fifth ventral is broadly arcuate at apex; the tibial spurs are smaller than in the male, that of the middle tibia very short and obscure, and I fail to detect any spur at all on the hind tibia; the basal joint of hind tarsus is not produced at apex.

This species is described from a good series of specimens collected by Mr. H. C. Davis of Pasadena, California on Santa Cruz Island, Calif., April, 1933. I have also a single example taken by Mr. F. E. Winters on the same island, and three examples from Santa Rosa Island, which have stood in my collection for many years prove to be the same thing. The type is a male from Mr. Davis' catch.

T. calcaratus superficially much resembles *sexualis* Csy., but quite lacks the complex sexual modification of the ventral apex of that species; the tibial spurs are also quite different. The extraordinary process of the basal joint of the hind tarsus in the present species is, so far as I am aware, wholly unique within the genus.

T. calcaratus should stand next to *sexualis* in Casey's table.

THE COLEOPTERA OF SANTA CRUZ ISLAND, CALIFORNIA.

BY H. C. FALL, A. C. DAVIS,
Tyngsboro, Mass., and Takoma Park, Md.

The "List of the Coleoptera of the Southern California Islands—" published by the senior author in 1897 (Can. Ent. 29, 1897, 233-244) was the result of more or less sporadic collecting upon the Channel Islands by several parties, few of them trained collectors of insects. The remarks in that paper concerning the inaccessibility of these islands with the exception of Santa Catalina still hold true. In order to reach the greater number of them it is necessary to charter a boat, no regular trips being made. The islands are privately owned, the larger ones being used for grazing purposes, and permission to land, camp, or collect must first be obtained from the owners.

Santa Cruz Island lies, at its nearest point, about 25 miles from the nearest mainland. It is the largest of the Channel Island group, being about 7 miles in maximum width and about 25 miles in length, the length almost due east and west. There are relatively few good landing places, the hills descending directly into the ocean at most points. Inland the ranges of hills rise steeply, attaining a maximum hight of about 2,400 feet, and are cut by many steep, narrow ravines. An excellent detailed account of the island, its geologic origin, and its mammalian fauna is included in Rogers' "Prehistoric Man of the Santa Barbara Coast" (Santa Barbara Museum of Natural History, Santa Barbara, California, 1929, 452 pp. i-xvii, illust.)

The present list consists of species recorded in the 1897 list as from Santa Cruz Island, with the addition of the species contained in a small collection made by H. C. Davis of Pasadena, California, on the island during April 1933. The latter collection contains several species not hitherto recorded from the islands, and several others not hitherto recorded from Santa Cruz.

Bembidion transversale Dej.†
Pterostichus laetulus Lec.
" *lustrans* Lec.†
Celia californica (Dej.)
Calathus ruficollis Dej.
Platynus brunneomarginatus Mann.
" *funebris* Lec.*
" *maculicollis* (Dej.)*
Dermestes talpinus Mann.
" *frischi* Kug.†
Carpophilus pallipennis Say.
Scymnus cinctus Lec.†
Psyllobora 20-maculata (Say) var. *taedata* Lec.*
Ceratomegilla vittigera (Mann.)
Hippodamia ambigua Lec.*

Brachynus tschernikhii Mann.†
Chlaenius cumatilis Lec.†
Anisodactylus semipunctatus Lec.†
" *consobrinus* Lec.*
Dicheirus dilatatus (Dej.)*
Glycerius nitidus Dej.†
Omophron dentatum Lec.
Hydrophilus lineatus (Lec.)
Tropisternus californicus (Lec.)
Silpha ramosa Say.
Saprinus lugens Er.*
" *oregonensis* Lec.†
" *lubricus* Lec.*
Cantharis consors Lec.†
Malthodes laticollis Lec.
Trichochrous calcaratus Fall.†
Eschatocrepis constrictus Lec.*
Hemicrepidius tumescens Lec.
Phloeodes diabolicus Lec.
Nyctoporis carinata Lec.*
Apsena barbarae Blaisd.*
Eleodes dentipes Esch.*
" *inculta* Lec.†
Coniontoides insularis Csy.
Coniontis viatica Esch.
" *subpubescens* Lec.
" sp.
Coelus pacificus Fall.*
Ulus crassus Lec.†
Blapstinus sp.†
Cratidus osculans Lec.
Amphidora littoralis Esch.*
Ernobius punctulatus (Lec.)
Polycaon stouti (Lec.)
Phobetus testaceus Lec.
Lema trilineata (Oliv.) var. *californica* Schffr.†

*Species not heretofore recorded from Santa Cruz Island.
†Species not heretofore recorded from the Channel Islands.

The great majority of the above are common mainland species.

The *Blapstinus* is different from the two previously recorded from the Channel Islands, *rufipes* and *brevicollis,* and may be undescribed.

Phobetus testaceus Lec. One pair included in the collection made by H. C. Davis answer to the description of this species almost exactly. The characters of the oedeagus separate it at once from *P. comatus* Lec. and *P. sloopi* Barrett, this organ being much more robust and evenly curved than that of *P. comatus* as viewed from the side, and the valves more evenly tapered as viewed posteriorly. This species should be raised to full specific rank if the characters of the oedeagus of the genus are held to be of value in separating species.

Of interest to collectors of other than Coleoptera, there was included in the collection above mentioned one species of ant and one bug. The ant was determined by M. R. Smith as *Pheidole hyatti* Emery, and the bug by H. G. Barber as *Eurygaster shoshone* Kirk. According to Mr. Barber the latter is possibly an extreme southern record of capture for this species.

Date Mailed, Saturday, June 30th, 1934.

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